4740

Plymouth Utilities
12 S. Milwaukee St. - P.O. Box 277
Plymouth, WI 53073-0277

CITY OF PLYMOUTH WISCONSIN
Wisconsin's Heartland . . . On the Grow

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January 24, 2001

Jim Loock, Chief Electric Engineer
Electric Division
Public Service Commission of Wisconsin
610 N. Whitney Way – P.O. Box 7854
Madison, WI 53707-7854

RE: Filing Plan for Appropriate Inspection and Maintenance of Electric System
PSC 113.0607
Utility No. 4740

Dear Loock:

Enclosed for filing are three (3) copies of Plymouth Utilities' Preventive Maintenance Plan detailing inspection maintenance schedules, condition rating criteria, corrective action schedules, record keeping procedures and report filing schedules as required under PSC 113.0607.

In short, should there be any questions on this filing, then please direct such to my attention.

Sincerely,

John T. MacKinnon

John T. MacKinnon, Manager

CITY OF PLYMOUTH WISCONSIN

Wisconsin's Heartland . . . On the Grow

PREVENTATIVE MAINTENANCE PLAN
PLYMOUTH UTILITIES

FILING DEADLINE

FEBRUARY 1, 2001

John T. MacKinnon, Manager

Ronald J. Navis, Electrical Superintendent

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12 S. Milwaukee St. – P.O. Box 277
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January 24, 2001

This plan was prepared by the MEUW work group for PSC Rule 113.0607 for use by the 82 municipal electric utilities in Wisconsin and endorsed by PSC staff as meeting the requirements of Rule PSC 113.0607.

TABLE OF CONTENTS

FORMS

I. Preventative Maintenance Plan

The PSC 113.0607 rule reads;

Appropriate inspection and maintenance: system reliability.

(1) PREVENTATIVE MAINTENANCE PLAN. Each utility or other person subject to this chapter, including persons who own electric generating facilities in this state who provide service to utilities with contracts of five years or more, shall develop and have in place its own preventative maintenance plan. This section is applicable to electric generating facilities as set forth at s. 194.491(5)(a)(1), Stats. Each plan shall include, among other things, appropriate inspection, maintenance and replacement cycles where applicable for overhead and underground distribution plant, transmission, generation[1], and substation facilities.

(2) CONTENTS OF THE PLAN. (a) *Performance standard.* The Preventative Maintenance Plan shall be designed to ensure high quality, safe, and reliable service, considering: cost, geography, weather, applicable codes, national electric industry practices, sound engineering judgment and experience.

1 *PSC staff interpretation is that generation applies to individual generators equal to or greater than 50 MW.*

II. Inspection Schedule and Methods:

The purpose of this plan is to maintain or improve the electrical system reliability with the objective of increased municipal loyalty and satisfaction from our constituents. The goals are to meet and exceed the schedules established in this plan.

Exception reporting (inspected equipment not in good condition) will be the method of documentation on all inspection forms.

The scope of this plan is traditional and uses proven maintenance techniques. Unique operating and maintenance philosophies have not been considered. Also, manufacturer defects will be dealt with as they are communicated to this utility.

SCHEDULE:	MONTHLY	ANNUAL	EVERY 5 YEARS
Transmission (≥69Kv and above)		X	X
Substations	X	X	
Distribution (OH & UG)			X

The inspection of Distribution facilities will be by individual substation circuits on a 5-year cycle such that the entire system will be inspected every 5 years. Inspector instructions for inspecting all facilities and forms are included with the plan.

METHODS: Five criteria groups will be used to complete the inspection of all facilities.

1. IR – infrared thermography used to find poor electrical connections and/or oil flow problems in equipment.
2. RFI - Radio Frequency Interference, a byproduct of loose hardware and connections, is checked using an AM radio receiver.
3. SI – structural integrity of all supporting hardware including poles, crossarms, insulators, structures, bases, foundations, buildings, etc.
4. Clearance – refers to proper spacing of conductors from objects, trees and other utility cables.
5. EC – equipment condition on non-structural components such as circuit breakers, transformers, regulators, reclosers, relays, batteries, capacitors, etc.

III. Condition Rating Criteria:

This criterion, as listed below, establishes the condition of a facility and also determines the repair schedule to correct deficiencies.

0) Good condition

1) Good condition but aging

2) Non-critical maintenance required – normally repair within 12 months

3) Priority maintenance required – normally repair within 90 days

4) Urgent maintenance required – report immediately to the utility and repair normally within 1 week

IV. Corrective Action Schedule

The rating criteria as listed above determine the corrective action schedule.

V. Record Keeping

All inspection forms and records will be retained for a minimum of 10 years. The inspection form contains all of the required critical information i.e. inspection dates, condition rating, schedule for repair and date of repair completion.

VI. Reporting Requirements

A report and summary of this plan's progress will be submitted every two years with the first report due to the Commission by February 1, 2003. The report will consist of a letter documenting the percent of inspections achieved compared to the schedule and a description of maintenance achieved within the scheduled time allowance.

VII DISTRIBUTION – OVERHEAD INSPECTION GUIDE

STRUCTURE

- Pole Condition
- Pole Leaning
- Crossarm Condition
- Insulators, Deadend, Pin
- Excess Fill or Soil Removal
- Pole Steps
- Grounds Intact
- Ground Molding
- Down Guys
- Guy Markers
- Guy Bonding/Insulator
- Signage - Location Number, Warning Sign
- Customer Equipment
- Conductor
- Tie Wires
- U Guard/Conduit Condition

EQUIPMENT

- Transformers
  - ✓ Oil Leaks
  - ✓ Bushing Condition
  - ✓ Grounding/Bonding
- Capacitors
  - ✓ Fuses Blown
  - ✓ Bushing Condition
  - ✓ Oil Leaks
  - ✓ Tank Bulged
  - ✓ Switches, Oil, Vacuum
  - ✓ Control Conduit/Wiring
  - ✓ Grounding/Bonding
- Switches - GOAB, Inline, Disconnect
  - ✓ Insulator Condition
  - ✓ Operating Handle/Locks
  - ✓ Linkage
  - ✓ Grounding/Bonding
  - ✓ Switch Number
- Cutouts
  - ✓ Insulator Condition
  - ✓ Fuse Size Tag

VII DISTRIBUTION – OVERHEAD INSPECTION GUIDE (con't)

EQUIPMENT (CON'T)

- Arrestor
  - ✓ Insulator Condition
  - ✓ Connections
  - ✓ Ground Lead Disconnection
- Cable Terminators
  - ✓ Insulator Condition
  - ✓ Grounding/Bonding

CLEARANCES

- Ground Line
- Buildings, Bridges, Swimming Pool, Etc.
- Communications Facilities
- Fuel Tanks
- Other Electric Utilities
- Transmission Lines
- Over Streets, Roads, Alleys, Highways
- Tree Trimming
  - ✓ Clearance From Line
  - ✓ Vines on Poles
  - ✓ Danger Trees

INFRARED SCAN

- Main Three-Phase Feeders
- Priority Overhead Transformer Banks
  - ✓ Bushing Connectors Primary
  - ✓ Bushing Connectors Secondary
  - ✓ General Tank Heating
- Current & Voltage Transformers if Applicable

RFI CHECK

- OH system with AM radio as each circuit is inspected

OVERHEAD DISTRIBUTION INSPECTION FORM

Date_____ **Inspected by**_____ **Sub**_____ **Ckt** _____

MAP AREA	STRUCTURE												EQUIPMENT						CLEARANCE					COMMENTS		
LOCATION	Pole Condition/Leaning	Crossarm Condition	Insulators, DE, Pin	Soil Conditions	Pole Steps	Grounds Intact, Molding	Down Guys and Markers	Guy Bond, Insulator	Signs, Loc#, Warning	Customer Equipment	Conductor and Ties	U'Guard/Conduit Cond	RFI Check	Transformer	Switches	Cutouts	Arresters	Terminators	Street Light	Tree Trimming	Ground Line Clearances	Building Clearances	Streets, Roads, Alleys	Communication Clearance	Rating Criteria --- 0) Good Condition 1) Good Condition but aging 2) Non-critical Maintenance Required 3) Priority Maintenance Required 4) Urgent Maintenace Required	Date Item Corrected	Corrected By

VIII DISTRIBUTION – UNDERGROUND INSPECTION GUIDE

STRUCTURAL (Exterior & Interior) Transformer, Primary Pedestal, Secondary Pedestal, Switchgear.

- Enclosure Condition
- Level/Leaning
- Security
- Grade/Accessibility (Shrubs, Customer Facilities, Fill/Excavation)
- Numbering
- Voids/Gaps
- Signage - Location Number, Warning Sign
- Pad/Vault Condition

EQUIPMENT

- Transformers
  - ✓ Oil Leaks
  - ✓ Bushing Condition
  - ✓ Grounding/Bonding
  - ✓ Elbows
  - ✓ Arrestors
  - ✓ Feed-Through
  - ✓ Cable Condition
  - ✓ Secondary Connections
- Primary Pedestals
  - ✓ Elbows
  - ✓ Junction Condition
  - ✓ Grounding/Bonding
- Secondary Pedestals
  - ✓ Secondary Connections
- Switches – URD Switchgear
  - ✓ Insulator Condition
  - ✓ Operating Handle Security
  - ✓ Linkage
  - ✓ Grounding/Bonding
  - ✓ Switch Number/Fuse Size & Number

INFRARED SCAN and RFI CHECK

- Main Three-Phase Feeders (Risers & Switchgear)
- Priority URD Transformer Banks
  - ✓ Bushing Connectors Primary
  - ✓ Bushing Connectors Secondary
  - ✓ General Tank Heating

UNDERGROUND DISTRIBUTION INSPECTION FORM Date_____Inspected by_____ Sub_____ Circuit_____

MAP AREA	STRUCTURE								EQUIPMENT				IR / RFI Scan		COMMENTS		
EQUIPMENT LOCATION	Enclosure Condition	Level / Leaning	Security	Grade / Accessibility	Numbering	Voids / Gaps	Signage	Pad / Vault Condition	**Transformers**, Leaks, Bushings, Grounding,Bonds,Elbows, Arrestors, Cable cond, Connections	**Primary Pedestals**, Elbows, Grounding, Bonds,Junction cond.	**Secondary Pedestals**, Connections	**Switches**, Signage, Insulators, Security, Linkage, Ground, Bonds	**Main Three Phase Feeders**, Risers & Switchgear	**Priority URD Transformers**, Bushings and Tank heating	Rating Criteria --- 0) Good Condition 1) Good Condition but aging 2) Non-critical Maintenance Required 3) Priority Maintenance Required 4) Urgent Maintenace Required	Date Item Corrected	Corrected By

IX SUBSTATION - MONTHLY INSPECTION GUIDE

TRANSFORMER MAIN TANK:

- Oil in bushings
- Bushing and arrestor porcelain
  - ✓ Cracks or chips
  - ✓ Rust or dirt
- Oil leaks
  - ✓ Main tank
  - ✓ Sample valves
  - ✓ Radiators
- Radiator bank
  - ✓ warm on top, cool at bottom
- Tank pressure
- Tank oil level
- Temperature gauge
- Cooling fans

TRANSFORMER LTC or VOLTAGE REGULATORS:

- Tank oil level
- Drag hand positions
- Cabinet light
- Operation count
- Tank pressure
- Cabinet heater
- Cabinet contamination

TRANSMISSION CIRCUIT BREAKERS:

- OPEN/CLOSED indicator
- CHARGED/DISCHARGED indicator
- Cabinet light
- Cabinet heater
- Operations counter
- Bushings and supports
  - ✓ Cracks or chips
  - ✓ Rust or dirt
- Line and load side disconnect switches
  - ✓ Properly labeled
  - ✓ Aligned properly
- Handles grounded
- Emergency trip button
- Air / Oil compressors
- Air / Oil pressure gauge
- Spring operated mechanism
- Oil level gauge
- Tank oil leaks
- Reset switch
- Cabinet contamination
- Vents clean
- Gas pressures for GCBs

IX SUBSTATION - MONTHLY INSPECTION GUIDE (con't)

FEEDER CIRCUIT BREAKERS / RECLOSERS

- OPEN/CLOSED indicator
- CHARGED/DISCHARGED indicator
- Cabinet light
- Cabinet heater
- Operations counter
- Bushings and supports
  - ✓ Cracks or chips
  - ✓ Rust or dirt
- Line and load side disconnect switches
  - ✓ Labeled properly
  - ✓ Aligned properly
  - ✓ Handles grounded
- Emergency trip button
- Oil level gauge
- Tank oil leaks
- Reset switch
- Cabinet contamination
- Vents clean
- Gas pressures for GCBs

HIGH AND LOW VOLTAGE BUSS WORK:

- Bushing, insulator, arrestor, and support insulators
  - ✓ Chips or cracks
  - ✓ Rust or dirt
- Bird nests
- Potential transformers bushings
  - ✓ Cracks or chips
  - ✓ Rust or dirt
- Cable terminators
  - ✓ Leaking fluid
  - ✓ Cracks or chips

MANUAL SWITCHES:

- Properly labeled
- Ground connections
- Positioning and alignment
- Bushing and support insulators
  - ✓ Cracks or chips
  - ✓ Rust or dirt

MOTOR OPERATED SWITCHES:

- OPEN/CLOSED indicator
- Properly labeled
- Cabinet heater
- Operations counter

IX SUBSTATION - MONTHLY INSPECTION GUIDE (con't)

CONTROL HOUSE/MISCELLANEOUS:

- Clock displays proper time
- AC/DC load center breakers
- Room temperature
- Rodents
- Panels labeled properly
- Panel lights
- Annunciator panel
- Panel meters
- SCADA system RTU
- SCADA alarms
- Position indicators agree
- Relay target information
- Emergency contact directory & dial tone for phone
- Safety Equipment

BATTERY:

- Liquid levels
- Proper float voltage on charger and battery
- Specific gravity in pilot cell
- Personal Protective Equipment
- Connection corrosion
- Leaking cells
- Dated solution in eyewash station

YARD AND FENCE:

- Fire extinguisher charged
- Fence ground connections
- Fence secured
- Security and emergency lights
- Site base and grade
- Standing water
- Warning signs

MONTHLY SUBSTATION INSPECTION FORM

INSPECTED BY:

DATE:

SUBSTATION:

TRANSFORMER MAIN TANK	RATING: 0 1 2 3 4 (Circle One)			
inspected	X	COMMENTS	DATE CORRECTED	CORRECTED BY
Oil in Bushings				
Bushing and Arrestor				
Oil Leaks				
Main Tank				
Sample Valves				
Radiators				
Radiator Bank				
Tank Pressure				
Tank Oil Level				
Temperature Gauge				
Cooling Fans				

TRANSFORMER LTC or VOLTAGE REGULATORS	RATING: 0 1 2 3 4 (Circle One)			
Tank Oil Level				
Drag Hand Positions				
Cabinet Light				
Operation Count				
Tank Pressure				
Cabinet Heater				
Cabinet Contamination				

MONTHLY SUBSTATION INSPECTION FORM

INSPECTED BY:

DATE:

SUBSTATION:

HIGH VOLTAGE CIRCUIT BREAKER / CIRCUIT SWITCHER **RATING: 0 1 2 3 4 (Circle One)**

inspected	X	COMMENTS	DATE CORRECTED	CORRECTED BY
OPEN/CLOSED Indicator				
CHARGED/DISCHARGED Indicator				
Cabinet Light				
Cabinet Heater				
Operations Counter				
Bushings and Supports				
Line and Load Side Disconnect Switches				
Handles Grounded				
Emergency Trip Button				
Air Compressors - Air / Oil				
Air Pressure Gauge - Air / Oil				
Spring Operated Mechanism				
Oil Level Gauge				
Tank Oil Leaks				
Reset Switch				
Cabinet Contamination				
Vents Clean				
Gas Pressures for GCBs				

MONTHLY SUBSTATION INSPECTION FORM

INSPECTED BY:

DATE:

SUBSTATION:

FEEDER CIRCUIT BREAKER / RECLOSER		RATING: 0 1 2 3 4 (Circle One)		
inspected	X	COMMENTS	DATE CORRECTED	CORRECTED BY
OPEN/CLOSED Indicator				
CHARGED/DISCHARGED Indicator				
Cabinet Light				
Cabinet Heater				
Operations Counter				
Bushings and Supports				
Line and Load Side Disconnect Switches				
Emergency Trip Button				
Oil Level Gauge				
Tank Oil Leaks				
Reset Switch				
Cabinet Contamination				
Vents Clean				
Gas Pressures for GCBs				

MONTHLY SUBSTATION INSPECTION FORM

INSPECTED BY:

DATE:

SUBSTATION:

HIGH & LOW VOLTAGE BUSS WORK **RATING: 0 1 2 3 4 (Circle One)**

inspected	X	COMMENTS	DATE CORRECTED	CORRECTED BY
Bushing, Insulator, Arrestor, and Supports				
Bird Nests				
Transformer Bushings				
Cable Terminators				

MANUAL SWITCHES **RATING: 0 1 2 3 4 (Circle One)**

Properly Labeled				
Ground Connections				
Positioning and Alignment				
Bushings and Supports				

MOTOR OPERATED SWITCHES **RATING: 0 1 2 3 4 (Circle One)**

OPEN/CLOSED Indicator				
Proper Labeling				
Cabinet Heater				
Operations Counter				
locking criteria				

MONTHLY SUBSTATION INSPECTION FORM

INSPECTED BY:

DATE:

SUBSTATION:

CONTROL HOUSE/MISCELLANEOUS	RATING: 0 1 2 3 4 (Circle One)			
inspected	X	COMMENTS	DATE CORRECTED	CORRECTED BY
Clock Displays Proper Time				
AC/DC Load Center Breakers				
Room Temperature				
Rodents				
Panels Labeled Properly				
Panel Lights				
Annunciator Panel				
Panel Meters				
SCADA System RTU				
SCADA Alarms				
Position Indicators Agree				
Relay Target Information				
Emergency Contact Directory & Dialtone for Phone				
Safety Equipment				
BATTERY	**RATING: 0 1 2 3 4 (Circle One)**			
Liquid Levels				
Proper Float Voltage on Charger & Battery				
Specific Gravity in Pilot Cell				
Personal Protective Equipment				
Connection Corrosion				
Leaking Cells				
Dated Solution in Eyewash Station				
YARD & FENCE	**RATING: 0 1 2 3 4 (Circle One)**			
Fire Extinguisher Charged				
Fence Ground Connections				
Fence Secured				
Security and Emergency Lights				
Site Base and Grade				
Standing Water				
Warning Signs				

X Substation - Annual Inspection Guide

- Check equipment for level
- Check condition of concrete pads
- Perform oil and DGA analysis
- Battery
  - ✓ Intercell strap resistance
  - ✓ Individual cell voltages
  - ✓ Cell specific gravity
- Nameplate legible
- Equipment paint condition
- Proper equipment ID labels
- IR / RFI scans and checks

ANNUAL SUBSTATION INSPECTION FORM

Date _____ **Inspected by** _____ **Substation** _____

	SUBSTATION INSPECTION CRITERIA								COMMENTS	MAINTENANCE COMPLETED	
EQUIPMENT LISTING	Check equipment for level	Check condition of concrete pads	Perform oil and DGA analysis	Battery checks - Intercell strap resistance, Individual cell voltages, Cell specific gravity	Nameplate legible	Equipment paint condition	Proper identification labels	IR / RFI scans and checks	Rating Criteria --- 0) Good Condition 1) Good Condition but aging 2) Non-critical Maintenance Required 3) Priority Maintenance Required 4) Urgent Maintenace Required	Date Item Corrected	Corrected By
Transformer											
LTC or regulators											
High Voltage Breaker											
Feeder CBs / Reclosers											
Switches											
Control house battery											
Transmission line RFI											

XI TRANSMISSION – ANNUAL INSPECTION GUIDE

STRUCTURE

- Pole Condition
- Pole Leaning
- Crossarm Condition
- Insulators, Deadend, Pin
- Excess Fill or Soil Removal
- Pole Steps
- Grounds Intact
- Ground Molding
- Down Guys
- Guy Markers
- Guy Bonding/Insulator
- Signage - Location Number, Warning Sign
- Customer Equipment
- Conductor
- Tie Wires

EQUIPMENT

- Switches - GOAB, Disconnect
  - ✓ Insulator Condition
  - ✓ Operating Handle/Locks
  - ✓ Linkage
  - ✓ Grounding/Bonding
  - ✓ Switch Number
- Arrestor
  - ✓ Insulator Condition
  - ✓ Connections

CLEARANCES

- Ground Line
- Buildings, Bridges, Etc.
- Communications Facilities
- Fuel Tanks
- Other Electric Utilities
- Over Streets, Roads, Alleys, Highways
- Tree Trimming
  - ✓ Clearance From Line
  - ✓ Vines on Poles
  - ✓ Danger Trees

XI TRANSMISSION – ANNUAL INSPECTION GUIDE (con't)

RFI CHECK

- Splices
- Connectors
- Dead Ends
- Switches
- Structures

XII TRANSMISSION – 5 YEAR INSPECTION GUIDE

IR SCAN

- Splices
- Connectors
- Dead Ends
- Switches

ANNUAL TRANSMISSION INSPECTION FORM

Date_____ Inspected by_____ Sub_____ Ckt _____

MAP AREA	STRUCTURE												EQUIPMENT		CLEARANCE					COMMENTS		
LOCATION	Pole Condition/Leaning	Crossarm Condition	Insulators, DE, Pin	Soil Conditions	Pole Steps	Grounds Intact, Molding	Down Guys and Markers	Guy Bond, Insulator	Signs, Loc#, Warning	Customer Equipment	Conductor and Ties	RFI Check	Switches	Arresters	Tree Trimming	Ground Line Clearances	Building Clearances	Streets, Roads, Alleys	Communication Clearance	Rating Criteria --- 0) Good Condition 1) Good Condition but aging 2) Non-critical Maintenance Required 3) Priority Maintenance Required 4) Urgent Maintenace Required	Date Item Corrected	Corrected By